MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2018/2019

TSW 3241 – SEMANTIC WEB TECHNOLOGY

(All sections / Groups)

5 March 2019
2:30pm – 4:30pm
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This Question paper consists of **TEN pages**, which includes the front cover, with **FIVE Questions** only.
2. Attempt **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please print all your answers in the answer booklet provided, and start each question on a new page.

Question 1 [10 marks]

(a) Explain the following terminologies:

(i) Semantic technology

[2 marks]

(ii) Resource Description Framework (RDF)

[2 marks]

(iii) Resource Description Framework Schema (RDFS)

[2 marks]

(b) The World Wide Web (WWW) is penetrating various aspects of human daily activities. List and explain TWO limitations of WWW.

[2 marks]

(c) A schema knowledge can be represented as either a taxonomy or a partonomy. State an example of taxonomy and an example of partonomy.

[2 marks]

Continued...

Question 2 [10 marks]

(a) A claim is made that "XML revolutionises software development". List THREE advantages of using Extensible Markup Language (XML).

[3 marks]

(b) Given the following information of a *person*:
The staff_ID is 109332287
The first_name of a person is Jayden, and his last_name is Choo
His address is composed of city (Bukit Beruang), postcode (75250), and street (Jalan Ayer Keroh)
His telephone numbers are 2523002 and 2523445

(i) Write an XML-document (by not using attributes) to include information above.

[4 marks]

(ii) Draw a tree diagram for (i).

[1 mark]

(c) The following XML document records some entries of a library.

```
<library>
  <book id=TK5105.88815>
    <title>Developing Semantic Web Services</title>
    <editor>H. Peter Alesso</editor>
    <publisher>A.K. Peters Ltd.</PUBLISHER>
  </book>
  <journal id="APS_007 publ_year="2003">
    <title>Applied Soft Computing</title>
    <volume>41<number>2</number></volume>
  </journal>
  <misc id="AES-3002" id="SD2017-12-05">
    <author>Jordan Smith</author>
    <title>Web Primer
    <year>2017</year>
    <pages>0</pages>
  </misc>
</library>
```

Check if the XML document is well-formed. If it is not, change it so that it becomes well-formed, making as little changes as possible. Write a well-formed XML document.

[2 marks]

Continued...

Question 3 [10 marks]

(a) A document in a Resource Description Framework (RDF) is written as follows:

```
<rdf:RDF
  xmlns:rdf="http://www.w3.orf/1999/02/22-rdf-syntax-ns#"
  xmlns:rdfs="http://www.w3.org/2000/010rdf-schema#"
  xmlns:iswww= "http://un.org/#"
>

<rdf:Description  rdf:about="http://un.org/#Thailand">
  <rdf:type  rdf:resource="http://un.org/#country">  />
</rdf:Description>

<rdf:Description  rdf:about="http://un.org/# Krung_Thep_Maha_Nakhon">
  <rdfs:label xml:lang="en">Bangkok</rdfs:label>
  <rdf:type  rdf:resource="http://un.org/#city" />
  <iswww: city_of rdf:resource="http://un.org/#" />
</rdf:Description>

</rdf:RDF>
```

Describe in natural language the content of this document.

[1.5 marks]

(b) Given a record from an album list, as follows:

title	studio	genre	length	singer
Reputation	MMX Studio	Pop	55:38	Taylor Swift

The Uniform Resource Identifier (URI) of the album is http://www.recshop/album#"
Write RDF/XML statements to represent the record.

[2.5 marks]

Continued...

Question 3 (continued...)

(c) Five Turtle statements without using prefixes are given below:

```
<http://dbpedia.org/resource/Massachusets>
<http://example.org/terms/capital>
<http://dbpedia.org/resource/Boston> .

<http://dbpedia.org/resource/Massachusets>
<http://example.org/terms/nickname>
"The Bay State" .

<http://dbpedia.org/resource/Boston>
<http://example.org/terms/inState>
<http://dbpedia.org/resource/Massachusets> .

<http://dbpedia.org/resource/Boston>
<http://example.org/terms/nickname>
"Beantown" .

<http://dbpedia.org/resource/Boston>
<http://example.org/terms/population>
"642,109"^^xsd:integer .
```

(i) Convert all statements above into another Turtle version using the following prefixes:

```
@prefix db: <http://dbpedia.org/resource/>
@prefix dbo: <http://example.org/terms/>
```

[5 marks]

(ii) Draw a graph to represent all statements.

[1 mark]

Continued...

Question 4 [10 marks]

(a) One of the species of Web Ontology Language (OWL) is OWL Lite. What are the TWO advantages of OWL Lite?

[1 mark]

(b) The richer the ontology language is, the more inefficient the reasoning support becomes. Discuss a compromise between efficiency power and efficient reasoning power of an ontology language.

[1 mark]

(c) Explain TWO limitations of Resource Description Framework Schema (RDFS).

[2 marks]

(d) Another species of OWL is OWL Description Logic (OWL DL). Use OWL DL to model the following sentences.

(i) The class peacock is a subclass of bird.

[2 marks]

(ii) Each pancake has chocolate as topping.

[2.5 marks]

(iii) Pencil, mouse and rose are not of the same class.

[1.5 marks]

Continued...

Question 5 [10 marks]

(a) Translate the following sentences into description logic.

(i) A human who has a child that is human

(ii) A human who has a grandchild

[1 mark]

(b) Use SROIQ to model the following sentences.

(i) James reports Robert

(ii) Robert has committed more than 10 crimes

[1 mark]

(c) Compute the most specific concept names to which **Superhero(Spiderman)** belongs.

Heroine	$\equiv$	Hero $\cap$ Female
MaleHero	$\equiv$	Hero $\cap \neg$Female
MutantHeroine	$\equiv$	Heroine $\cap$ Mutant
Elite	$\equiv$	Rich $\cup \neg$Human
Superhero	$\equiv$	Hero $\cap$ Elite

[1 mark]

(d) Given the following knowledgebase:

$\text{Student} \subseteq \exists \text{attends}.\text{Seminar}$

$\text{Seminar} \subseteq \exists \text{attendedBy}.(\text{Student} \cap \text{Excited})$

$\text{Student}(\text{aStudent})$

$\neg\text{Excited}(\text{aStudent})$

Translate the knowledgebase above into a datalog program.

[2 marks]

Continued...

Question 5 (continued...)

(e) Given a database as follows:

```
@prefix swp:
<http://www.semanticwebprimer.org/ontology/apartments.ttl#> .

@prefix dbpedia: <http://dbpedia.org/resource/> .

@prefix dbpedia-owl: <http://dbpedia.org/ontology/> .


swp:BaronWayApartment  swp:hasNumberOfBedrooms  3.

swp:BaronWayApartment  dbpedia-owl:location  dbpedia:Amsterdam.

swp:BaronWayApartment  rdfs:label  "Baron Way Apartment for Rent".


swp:FloridaAveStudio  swp:hasNumberOfBedrooms  1.

swp:FloridaAveStudio  dbpedia-owl:locationCity  dbpedia:Amsterdam.


swp:SorrentoBungalow  swp:hasNumberOfBedroom  4.

swp:SorrentoBungalow  dbpedia-owl:locationCity  dbpedia: Amsterdam.
```

(i) Write an SPARQL query to sort, in an ascending way, the number of *bedrooms* available in all *housetypes*.

[3 marks]

(ii) Write the results from the SPARQL query in (i).

[2 marks]

Continued...

APPENDIX

1. Overview of OWL 1 Language Constructs

1.1 Header

rdfs:comment	owl:versionInfo	owl:DeprecatedClass
rdfs:seeAlso	owl:priorversion	owl:DeprecatedProperty
rdfs:label	owl:backwardCompatibleWith	owl:imports
rdfs:isDefineBy	owl:incompatibleWith	

1.2 Relations Between Individuals

owl:sameAs		owl:differentFrom
owl:AllDifferent	together with	owl:distinctMembers

1.3 Class Constructs and Relationships

owl:Class	owl:Thing	owl:Nothing
rdfs:subClassOf	owl:disjointWith*	owl:equivalentClass
owl:intersectionOf	owl:unionOf*	owl:complementOf*

1.4 Role Constructors, Relationships and Characteristics

owl:ObjectProperty	owl:FunctionalProperty	rdfs:range
rdfs:subPropertyOf	owl:inverseOf	owl:SymmetricProperty
rdfs:domain	owl:DatatypeProperty	owl:InverseFunctionalProperty
owl:TranstiveProperty	owl:equivalentProperty	

1.5 Allowed Datatypes

The standard only requires the support of xsd:string and xsd:integer

xsd:string	xsd:boolean	xsd:decimal
xsd:float	xsd:double	xsd:dateTime
xsd:time	xsd:date	xsd:gYearMonth
xsd:gYear	xsd:gMonthDay	xsd:gDay
xsd:gMonth	xsd:hexBinary	xsd:base64Binary
xsd:anyURI	xsd:token	xsd:normalizedString
xsd:language	xsd:NMTOKEN	xsd:positiveInteger
xsd:NCName	xsd:Name	xsd:nonPositiveInteger
xsd:long	xsd:int	xsd:negativeInteger
xsd:short	xsd:byte	xsd:nonNegativeInteger
xsd:unsignedLong	xsd:unsignedInt	xsd:unsignedShort
xsd:unsignedByte	xsd:integer	

Continued...

2. Overview of Additional OWL 2 Language Constructs

2.1 Declaring Individuals

owl:NamedIndividual	

2.2 Class Relationships

owl:disjointUnionOf	owl:AllDisjointClasses	owl:members

2.3 Role Characteristics and Relationships

owl:AsymmetricProperty	owl:ReflexiveProperty
owl:IrreflextiveProperty	owl:topDataProperty
owl:topObjectProperty	owl:bottomDataProperty
owl:bottomObjectProperty	owl:AllDisjointProperty
owl:propertyDisjointWith	owl:hasKey
owl:propertyChainAxiom	owl:inverseOf

2.4 Role Restrictions

owl:maxQualifiedCardinality	owl: minQualifiedCardinality
owl:qualifiedCardinality	owl:onClass
owl:onDataRange	owl:hasSelf

2.5 Role Assignments

owl:NegativePropertyAssertion	owl: sourceIndividual
owl:assertionProperty	owl:targetIndividual
owl:targetValue	

2.6 Datatype Restrictions

owl:onDataType	owl: withRestrictions
owl:datatypeComplementOf	

2.7 Additional Datatypes

owl:real	owl:rational	rdf:PlainLiteral
rdf:XMLLiteral	xsd:dateTimeStamp	

End of Paper